that taking the State or section as a whole the maximum and minimum occurring within it and the general range for the section might be comparable with similar numbers for other sections, and that thus we might study the relative climatology of the different sections, but this has not yet been done to any great extent. We can take the average of the departures of all the stations from their respective normals, and thus obtain an average departure for the whole section, but even this has no value in climatology when the stations have a wide range in altitude, latitude, or longitude. The study of climatology is coming down more and more into details, and these so-called absolute maxima and minima by sections cover up the very details that we wish to study.

Finally we note "The absolute maximum of 95° was, with two exceptions, the lowest of record for the month, while the absolute minimum was the highest with one exception". We think that the writer was endeavoring to communicate something that had imprest him as peculiar and perhaps remarkable, as to the weather in his section during September, 1906, but we do not ourselves get any clear idea from this paragraph and we think it should be rewritten, omitting the word "absolute", and mentioning the names of the stations.—*C. A.*

## ADAM PAULSEN (1833-1907).

Prof. Adam F. W. Paulsen, director of the Danish Meteorological Institute—the national weather service of Denmark—died January 11, 1907, at the age of 74.

In addition to his many other activities as the head of the Danish meteorological service and as a member of the International Meteorological Committee, Professor Paulsen was especially interested in two important projects—the study of the aurora, and the establishment of telegraphic communication between Europe and Iceland, for meteorological purposes. The cable to Iceland became an accomplished fact shortly before his death, and is a lasting monument to his memory. The discouraging financial difficulties that he had to overcome in achieving this result have been set forth in his reports to the International Meteorological Committee.

Paulsen's investigations of the aurora date from the international polar expeditions of 1882–1883, in which he took part as leader of the Danish expedition to the west coast of Greenland. In 1899–1900 he led an expedition to northern Iceland for the special purpose of studying the aurora. The results of the latter expedition included some remarkable photographs of auroral spectra, and new measurements of the altitude of the rayless auroral arch, indicating that it occurred at not less than four or five hundred kilometers from the earth's surface. At this height the atmosphere must be so rarified that ordinary electrical discharges would be impossible. In a paper[1] published a few months before his death Paulsen reaches the conclusion that the cause of the aurora is to be sought in an immense ionization and negative electrification of the upper layers of the atmosphere, produced by cathode rays emitted from the sun.

Professor Paulsen's successor as director of the Meteorological Institute is Capt. Carl Ryder, who has heretofore been known to science chiefly as an arctic explorer.—*C. F. T.*

## WEATHER BUREAU MEN AS EDUCATORS.

The following lectures and addresses by Weather Bureau men have been reported:

Mr. S. S. Bassler, March 5, 1907, before the Cincinnati Society of Natural History, on "The weather map".

Mr. Ford A. Carpenter, March 9, 1907, before the Scholia Club, of San Diego, Cal., on "What makes the climate of San Diego"?

Mr. George M. Chappel, March 20, 1907, before the teachers and pupils of the North High School, Des Moines, Iowa, on "The work of the Weather Bureau".

Mr. David Cuthbertson, March 27, 1907, before the West Side Business Men's Association, of Buffalo, N. Y., on "The usefulness of the Weather Bureau to the commercial interests".

Mr. C. F. von Herrmann, March 23, 1907, before the Alpha Delta Epsilon Scientific Fraternity, of Johns Hopkins University, Baltimore, Md., on "The principles of forecasting the weather".

Mr. J. R. Weeks, March 18, 1907, before pupils of the Washington Street Public School, Binghamton, N. Y.; also March 21, before the successful scholarship contestants of the Binghamton Republican, on "The work of the Weather Bureau".

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Classes from universities, academies, and schools have visited Weather Bureau offices, to study the instruments and equipment and receive informal instruction, as reported from the following offices:

Meridian, Miss., March 14, 1907, the physics class from Moffat-McLaurin Institute.

Mobile, Ala., March 22, 1907, a section of the physical geography class from Barton Academy.

Salt Lake City, Utah, during March, 1907, students from the Salt Lake High School and the Latter Day Saints' University.

## BELLS AS BAROMETERS.

We find a misleading paragraph under the above heading going the rounds of the press to the effect that "about five miles from Lebekke, in Belgium, there are some small church bells known as the 'water bells'. When they are heard distinctly in the town rain is sure to follow". With this paragraph goes a so-called "plausible popular explanation of the phenomenon", about as follows:

"If bells sound very distinctly of an evening, this points to the probability of a wet day following, since air heavily charged with moisture conducts sound better than dry air. So, too, as dense air conducts better than light air, bells sound more clearly when the barometer is high than when it is low, other things being equal; and so, too, with hot and cold air".

There are several errors in this explanation. It may be acceptable to teachers and others if we add that the intensity and quality of a sound depends primarily on the bell, and the tower in which it is hung, but only to an infinitesimal degree, if at all, on the temperature of the air, or the quantity of aqueous vapor contained therein, or on the relative humidity of the air. On the other hand the intensity of sound, observed at a distance, does depend to a very large extent on the homogeneity of the air, while the distance to which a sound is heard depends on the direction of the wind. If the air is perfectly homogeneous then the effect of a horizontal wind, which is usually feeble near the ground and strong higher up, is to bend the rays of sound out of their straight line directions. If the observer is to windward of the bell, the sound that should come to him passes over his head, and if he is to leeward the sound that should pass over his head is brought down to him. If he is to leeward of a house or island the irregularities of the wind may bend the sound wave entirely away from him. If he is in a calm stratum, as in the early morning, with the wind blowing strong above him, then he may hear no sound if he is to windward of the bell, but a more intense sound if he is to leeward. Ordinarily the air is not homogeneous, but is a mixture of warm and cold, or dry and moist masses, that is to say, a mixture of rarer and denser portions that break up waves of sound. Especially during hot sunshine does the air become acoustically opaque, that is

[1] Sur les récentes théories de l'aurore polaire. Résumé et critique des théories de MM. Birkeland, Arrhenius et Nordmann. Idées personnelles. (Académie royale des sciences et des lettres de Danemark. Extrait du bulletin de l'année, 1906. No. 2.)

to say, the rays of sound, having to pass thru many alternations of rarer and denser air, are reflected and refracted at every transmission, losing in intensity at every change, so that the range of audibility of a bell is always less in sunny weather than in cloudy weather, less during the daytime than at nighttime, less over the land than it is over the sea, and less over the lowlands than it is on the mountain tops. During still quiet nights, beneath a layer of clouds, the atmosphere is usually most homogeneous as to temperature and moisture; and, if there be no wind, sounds are then heard to the greatest distance. There are many peculiarities in the distribution of sound that have been especially studied in connection with fog signals on the coasts of Europe and America, but we believe all have been explained by considering the refraction of sound caused by differences of wind, by differences of density, by the presence of two currents of air passing each other, by the reflection from a sheet of falling rain, by reflection from the waves of the ocean, and by the irregularities of the land. If the audibility of distant sounds is a sign of coming rain, it is generally because the skies have become clouded over, or the wind has shifted preparatory to rain; but not because the air has become more heavily charged with moisture, nor because moist air conducts sound better than dry air, nor because the dense air of a high barometer conducts sound better than the rarefied air of a low barometer, nor because cold air conducts sound better than hot air. These four influences are negligible compared with homogeneity.

The diminution of sound is perfectly analogous to that of light. Everyone knows how easily light passes thru clear air or pure water, but it will not pass thru a mixture of air and water, such as a glass full of bubbles, or a fog or cloud, or a sheet of falling rain.—*C. A.*

## RECENT ADDITIONS TO THE WEATHER BUREAU LIBRARY.

H. H. KIMBALL, Librarian.

The following titles have been selected from among the books recently received, as representing those most likely to be useful to Weather Bureau officials in their meteorological work and studies. Most of them can be loaned for a limited time to officials and employees who make application for them.

**Anderson, Richard.**
Lightning conductors; their history, nature, and mode of application. 3d ed. London. 1885. xv, 470 p. 8°.

**Angot, Alfred.**
Traité élémentaire de météorologie. 2d ed. Paris. 1907. vi, 416 p. 4°.

**Austria. K. k. Zentralanstalt für Meteorologie und Geodynamik.**
Allgemeiner Bericht und Chronik der im Jahre 1904 in Osterreich beobachteten Erdbeben. No. 1. Offizielle Publikation. Wien. 1906. vii, 155 p. 8°.

**Batavia. Koninklijk magnetisch en meteorologisch Observatorium.**
Regenwaarnemingen in Nederlandsch-Indie. 27 Jaargang. Batavia. 1906. xi, 380 p. 4°.

**Black, W. G.**
Ocean rainfall by rain-gage observations at sea. General and special oceans. 1864, 1875, 1881. New ed. [Repr. J. Manchester geogr. soc. v. 14, 1898.] Edinburgh. n. d. 21 p. 8°.

**Blanchard, Raoul.**
La Flandre. Paris. 1906. viii, 530 p. 4°.

**Bouches-du-Rhone. Commission de météorologie.**
Bulletin annuel. 1905. Marseille. 1906. x, 113 p. 4°.

**Bravo, Carlos.**
... La patria Boliviana. Estado geográfica. La Paz. 1894. 204 p. 8°.

**Cape of Good Hope. Meteorological commission.**
Report 1905. Cape Town. 1906. xiv, 127 p. f°.

**Ceylon. Surveyor general.**
Meteorology [1905]. (Extr. Ceylon administration reports for 1905.) n. p. n. d. F1-F44 p. f°.

**Coester, A. and Gerland, E.**
Beschreibung der Sammlung astronomischer, geodätischer und physikalischer Apparate im Königlichen Museum zu Cassel. Cassel. 1878. 48 p. 4.

**Courty, Fernand.**
Climatologie du littoral Atlantique français ... Paris. 1905. 14 p. 8°.

**Defant, A[lbert].**
Die Anhängigkeit der diffusen Wärmestrahlung von der Jahreszeit. (S.-A. Berichte Nat.-med. Innsbruck. 30. Jahrg. 1905-6.) Innsbruck. n. d.

**Dörr, —.**
Die Beobachtungsergebnisse der meteorologischen Stationen niederer Ordnung im Herzogtum Braunschweig während des Zeitraumes 1878–1905. (S.-A. Beiträge Statist. Herz. Braunschw. Heft 20. 1907.) 38 p. f°.

**Egypt. Survey department.**
Meteorological report for the year 1904. Part 1. Cairo. 1906. f°.
Report on the work of the Survey department. 1905. Cairo. 1906. 76 p. 4°.

**Guzman, David Y.**
Apuntamientos sobre la topografia fisica de la República del Salvador. San Salvador. 1883. xix, [20]–535 p. 8°.

**Hamburg. Deutsche Seewarte.**
Deutsches meteorologisches Jahrbuch. Hamburg. 1906. vi, 192 p. f°.

**Hann, J[ulius].**
Der tägliche Gang der Temperatur in der äusseren Tropenzone. A. Das amerikanische und afrikanische Tropengebiet. (Denkschr. Akad. Wien. 80. Bd.) Wien, 1907.

**Huggard, W. R. and others.**
Davos as health resort ... Davos. 1906. iv, 316 p. 8°.

**Hungary. Kgl ung. Reichsanstalt für Meteorologie u. Erdmagnetismus.**
Bericht über die Tätigkeit. 1905. Budapest. 1906. 30 p. 8°.
Jahrbuch. 34 Band. 1904. Theile 1-3. Budapest. 1906. v. p. f°.

**International meteorological committee.**
Internationaler meteorologischer Kodex. Im Auftrage des Internationalen meteorologischen Komitees bearbeitet von G. Hellmann und H. H. Hildebrandsson. Deutsche Ausgabe besorgt von dem Königlich preussichen meteorologischen Institut. Berlin. 1907. viii, 81 p. 4°.

**Juiz de Fora. Servico meteorologico.**
Boletim. 1906. n. p. n. d. f°.

**Knoch, Karl.**
Die Niederschlagsverhältnisse der Atlasländer. Frankfurt a. M. [1906.] 86 p. 8°.

**Krakau. Observatoryum.**
...Materyaly zebrane przez sekcye meteorologiczna. [1905.] n. p. n. d. 73 p. 8°.

**London. Solar physics observatory, South Kensington.**
Report. 1906. n. p. n. d. 15 p. 8°.

**Lutz, Karl Wolfgang.**
Untersuchungen über atmosphärische Elektrizität mit besonderer Berücksichtigung ihrer technischen Bedeutung. [München. 1904.] 102 p. 4°.

**Maugham, R. C. F.**
Portuguese East Africa. New York. 1906. xii, 340 p. 8°.

**Möller, M.**
Flut und Witterung. Braunschweig. 1905. vi, 24 p. 8°.

**Moscow. Agricultural institute. Meteorological observatory.**
Observations. 1905. Moskva. 1987. xxx, 72 p. 4°.

**Pastrana, Manuel E.**
La sección meteorológica del estado de Yucatán. Mexico. 1906. 99 p. f°.

**Prussia. Königliches preussisches meteorologisches Institut.**
Ergebnisse der Beobachtungen an den Stationen II. and III. Ordnung im Jahre 1901 ... Berlin. 1906. xvi, 124-279 p. f°.

**Rakhmanov, G.**
Osnovy meteorologii. [Elements of meteorology.] (Russ.) Moskva. 1902. li, 118 p. 8°.

**Richter, Eugen.**
Die Witterungskunde für den Haus-, Land- und Forstwirt. Regensburg. n. d. 30 p. 16°.

**Rizzo, G. B.**
Sopra il calcolo della profondità degli ipocentri nei movimenti sismici. (Estr. Accad. sc. Torino. v. 41. 17 giugno 1906.) Torino. 1906. 8p. 8°.
Sulla velocità di propagazione delle onde sismiche nel terremoto della Calabria del giorno 8 settembre 1905. (Estr. Mem. Accad. sc. Torino. Ser. II, Tom. 57. 17 giugno 1906.) Torino. 1906. p. [309]-350. f°.

**Royal society of New South Wales.**
Journal and proceedings. 1905. Sydney. 1905. v. p. 8°.

**Rykachev, M.**
Novyii isparitel dlia nabliupenii nad ispareniem travy i pervyia nabliudeniia po nem v Konstantinovskoi observatorii y 1896 g. [New evaporometer for observing evaporation from the grass, and first observations with this instrument at the Constantine observatory in 1896.] St. Petersbug. 50 p. f°. (Mém. Acad. sc., St. Petersburg. 7 sér. Classe phys.-math. v. 7. No. 3.)

**South Australia. Government astronomer.**
Meteorological observations made at the Adelaide observatory and other places ... 1902-3. Adelaide. 1905. xx, 65 p. f°.